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U. S. DEPARTMENT OF AGRICULTURE.

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REPORT

OF

THE BOTANIST

FOR

1891.

BY

GEORGE VASEY.

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FROM THE REPORT OF THE SECRETARY OF AGRICULTURE FOR 1891.

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WASHINGTON:  
GOVERNMENT PRINTING OFFICE.  
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SIR: I have the pleasure of presenting herewith a report of the work of this division for the year 1891. It contains a statement of the results of the grass and forage experiments, and an account of the office and herbarium work, together with a short paper on the vegetation of the desert region of the Southwest, and an account of some new and injurious weeds.

Respectfully,

GEO. VASEY,  
*Botanist.*

Hon. J. M. RUSK,  
*Secretary.*

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### FIELD WORK.

The past year has been one of unusual activity in the work of this division. A number of field agents have been employed in different parts of the country in an investigation of its vegetation, in order that the herbarium may be supplied with specimens and a more complete knowledge of the productions and resources of the country be obtained. The collection of specimens has been made in such quantities as to enable us to aid the agricultural colleges in the formation of their herbariums. The principal agents have been in Texas, Arizona, and adjacent parts of Mexico, Indian Territory, Minnesota, and Florida. From these agents we have received about 50,000 specimens.

An expedition was organized in January by the Division of Economic Ornithology and Mammalogy, in connection with the Division of Botany, for an exploration of the Death Valley of southern California, for the purpose of investigating the productions and resources of that remarkable region and the adjacent mountain ranges, and to mark the floral and faunal limits. This division was represented in the expedition by Mr. F. V. Coville as botanist, assisted by Mr. Frederick Funston. The field work continued until the 1st of September. The botanical report of the work of the expedition will be published later in the Contributions from the National Herbarium.

The herbarium of the Department has been further enlarged by exchange and by purchase of specimens from the following countries:

	Specimens.
From Canada .....	1, 000
From Mexico .....	287
From Central America .....	268
From South America .....	420
From New Zealand .....	450
From India .....	1, 310
From Africa .....	107



From our duplicates we have distributed about 6,000 specimens among thirty-one agricultural colleges and experiment stations. Nine thousand specimens have been mounted and added to the herbarium.

### PUBLICATIONS.

Bulletin No. 12. Grasses of the Southwest: Plates and Descriptions of the Grasses of the Desert Region of Western Texas, New Mexico, Arizona, and southern California. By Dr. George Vasey. Part 2. Issued Oct., 1891. Roy. 8°, pp. 7+[50], 50 plates.

Contributions from the U. S. National Herbarium. List of plants collected by Dr. Edward Palmer in 1890 in Lower California and western Mexico, at La Paz, San Pedro Martir, Raza Island, Santa Rosalia, Santa Agueda and Guaymas. By Drs. George Vasey and J. N. Rose. Vol. I. No. 3. Issued Nov. 1, 1890. 8°, pp. iii+63-90. Index.

This paper is a report on 173 species collected at the above localities, including the collector's notes with remarks on new and rare species.

Contributions from the U. S. National Herbarium. List of plants collected by Dr. Edward Palmer in 1890 in western Mexico and Arizona. By J. N. Rose. Vol. I. No. 4. Issued June 30, 1891. 8°, pp. iii+91-127. 10 plates. Index.

In this paper 475 plants are enumerated with remarks as to soil, locality, size, and additional notes in case of rare or little known species, and with descriptions of new species.

Contributions from the National Herbarium. Manual of the Phanerogams and Pteridophytes of western Texas. By Dr. J. M. Coulter. Vol. II. No. 1. Issued June 27, 1891. 8°, pp. iv+152. Index.

This contribution is Part I of a manual for western Texas, and includes the Polypetalæ. It begins with an analytical key to the orders, followed by similar keys to the families. The number of genera enumerated and described is 270 and of species 761.

Bulletin No. 14. *Ilex cassine*: The aboriginal North American Tea. By Dr. E. M. Hale. Issued Nov., 1891. 8°, pp. 22, 1 plate.

This is a report upon the history, distribution, and use among the North American Indians of *Ilex cassine*.

### GRASS AND FORAGE EXPERIMENT STATION AT GARDEN CITY, KANS.

By Dr. J. A. SEWALL, *Superintendent*.

An account of this station was given in the Report of the Secretary of Agriculture for 1890. The following is a report of operations for the year 1891, the third year of the experiments.

The area under cultivation at this station for the season of 1891 is about 220 acres, divided as follows:

ANNUAL CROPS.		Acres.
Winter rye.....		40
Jerusalem corn.....		50
Poland wheat.....		10
Algerian wheat.....		2
Algerian barley.....		1
Ten varieties of corn.....		10
Sorghum (20 varieties nonsaccharine).....		30
Broom corn.....		5

Of the above, the rye, wheat, barley, and sorghums were cultivated for the double purpose of determining their value as a crop without irrigation, and for the purpose of putting the newly broken ground into condition to sow grass seeds.



The yield was about as follows:

	Bushels.
Jerusalem corn.....	2,000
Polish wheat .....	240
Winter rye .....	500
Algerian barley.....	14
Red Kaffir corn .....	75

The sorghums are not harvested at this date, but the yield of each of the varieties will be above the average. The broom corn did fairly well, yielding about  $1\frac{1}{2}$  tons of excellent broom. (It will be proper here to state that the Jerusalem corn, the Kaffir corn, and broom corn are all varieties of *Sorghum vulgare*.) The 10 acres of alfalfa yielded two cuttings, and is in a promising condition for the future, although further trial is necessary before its permanency can be considered as established.

From the result of experiments for three seasons I believe that the "red Kaffir corn" is in every way superior to any of the varieties tested for fodder, as it furnishes more and better fodder than any other kind tried. The Jerusalem corn is of great value for its large and abundant yield of seed, which is as valuable as Indian corn for fattening hogs and cattle, and is also a fair food for human kind.

All the crops, especially the rye, wheat, and barley, suffered from the effect of the early drought. The rainfall from January 1, 1891, to May 21, 1891, was only 1.41 inches. From May 21 to October 3, 1891, the rainfall was 23.20 inches, or nearly 3 inches more than the average.

#### PERENNIAL CROPS.

	A cres.
<i>Panicum virgatum</i> , or switch-grass, a native grass for meadows .....	20
<i>Agropyrum glaucum</i> , or Colorado blue-stem, a native grass.....	10
<i>Bromus inermis</i> , a European pasture grass.....	6
<i>Andropogon provincialis</i> , or tall blue-joint, a native grass.....	5
<i>Andropogon Hallii</i> (Colorado sand-grass), a native grass .....	2
<i>Andropogon scoparius</i> , or broom-grass, a native grass.....	1
<i>Arena elatior</i> , or <i>Arrhenatherum arenaceum</i> , a European meadow-grass.....	5
<i>Festuca elatior</i> (tall meadow fescue), a European meadow-grass .....	2
<i>Lolium perenne</i> (perennial rye grass), a European meadow-grass .....	5
<i>Festuca ovina</i> (sheep's fescue), a European meadow-grass .....	$\frac{1}{2}$
<i>Agropyrum tenerum</i> , a native grass .....	1
<i>Muhlenbergia glomerata</i> , a native grass .....	$\frac{1}{2}$
Alfalfa, or Lucerne, a fodder-plant .....	10
Sainfoin ( <i>Onobrychis sativa</i> ), a European fodder-plant.....	1

In addition to the above, small areas ranging from 1 to 20 rods were sown with a variety of grasses and forage plants, among which are: *Vetches* (2 varieties), *Anthyllis vulneraria*, *Galega officinalis* (a French forage plant); *Trifolium hybridum* (Alsike clover), *Trifolium incarnatum* (French or crimson clover), and *Trifolium stoloniferum*. These were greatly injured by grasshoppers in July, consequently no seeds were secured, but they have nearly recovered since.

From experiments conducted here during the past three years, I am satisfied that the following-named crops will succeed on the so-called arid or subarid plains, even in the driest seasons: Jerusalem corn, with proper cultivation, will yield from 40 to 50 bushels of seed per acre; red Kaffir corn will yield from 5 to 7 tons of excellent fodder per acre, superior to alfalfa as food for horses; *Panicum virgatum*, a native grass, sometimes called switch-grass, will yield from  $1\frac{1}{2}$  to 2 tons of hay per acre, superior to alfalfa as food for horses; *Bromus inermis* will yield from one-half to 3 tons per acre (2 cuttings), and is equal or superior to timothy for cattle or horses.



Of the four above-named plants I can speak with great confidence. Many others do well and give hopeful promise, but further trial is necessary before they can be placed in the "certain" list.

By direction of the Assistant Secretary of Agriculture, I planted as a wind-break and shelter belt four rows of trees (3,000) around a quarter section of the experiment grounds, viz, one row of cottonwood, two of black locust, and one of Russian mulberry. Owing to the early drought before mentioned, one-third failed to grow, but the balance, after the rains in June, made a vigorous growth. The black locust proved to be decidedly superior, not more than 5 per cent dying.

Over 8,000 applications for seeds have been made at this office (Garden City) the last season, nearly all being for Jerusalem corn and *Bromus inermis*. We were not able to fill more than one-third of these orders, but with the crops now on hand we hope to fill all reasonable applications.

With reference to the experiments as a whole, I know that with fair culture in this region, without irrigation, any person can raise every year a paying crop of winter rye, and during the driest year a good crop of Jerusalem corn, ordinarily a fair, and with a reasonable amount of rainfall a large, crop of Polish wheat, and above all a meadow and pasture of good productive and hardy grasses, one of which, called *Bromus inermis*, or brome-grass, is one of the best grasses in existence. This is a European grass recently brought into cultivation here. Nine-tenths of the corn was destroyed by the ravages of the corn worm. Reports on the Polish wheat distributed last winter state a yield of from 20 to 60 bushels per acre, without irrigation. There have been large crops of Jerusalem corn from the seed distributed last winter. The rainfall at this station up to October 3 has been 24.61 inches, while the average for the past fifteen years has been 20.27 inches.

#### COÖPERATIVE STATIONS IN THE WEST AND SOUTHWEST.

Arrangements for coöperative experiments in grasses and forage plants were made with the following Western experiment stations, viz, Texas, New Mexico, Arizona, Colorado, North and South Dakota, Utah, and Wyoming. In most of these stations the experiments are yet in an incipient stage, and the results have not been reported in detail. Prof. Dice McLaren, of the Wyoming Experiment Station, briefly states as follows:

All of the twenty grasses selected by you for the 1891 experiments germinated and appeared above the ground. The following were almost completely killed by the June drought: *Poa nemoralis*, *Dactylis glomerata*, *Panicum virgatum*, *Aira cæspitosa*, *Trifolium incarnatum*, and *Melilotus alba*.

The following have a very thin stand: *Trifolium hybridum*, *Hedysarum coronarium*, *Galega officinalis*, and *Poterium sanguisorba*.

The following are a success on plowed ground, and are given in the order of their excellence: *Medicago sativa*, *Lolium perenne*, *Festuca elatior*, *Bromus Schraderi*, *Bromus inermis*, *Phalaris arundinacea*, *Anthyllis vulneraria*, and *Onobrychis sativa*.

The *Panicum miliaceum* and the Jerusalem corn grow about 8 inches high, with good stand, but the frosts of August and September checked all further growth.

#### COÖPERATIVE BRANCH STATIONS IN THE SOUTH.

By S. M. TRACY.

In 1888 a branch station for special work with grasses and forage plants was established at the Mississippi Experiment Station, and in March, 1891, additional branches were established in connection with



the State experiment stations of North Carolina, Georgia, Florida, and Louisiana, all of which have been placed under the general supervision of S. M. Tracy, the director of the Mississippi Station. The work at the four stations last named has been in progress for such a short time that it is now too early to state results, though excellent progress has been made and these stations are now in fine condition. The results of work with some of the more common species at the Mississippi Station are given in the Report of the Department of Agriculture for 1889, and these, with but little modification, fairly represent the work of the present season. As one of the principal objects of the work at this station was the testing of the newer and less known sorts, special pains were taken to procure seeds of such native species as seemed to promise future value, and also of such foreign species as had proved valuable in their native countries. Quite a number of species from the arid regions in the Southwest, several local species, and a large number from Australia, India, Russia, and other foreign countries, are now under cultivation tests. Of most of these only very small amounts of seed could be procured, and the areas grown were necessarily small, but seeds from the plats of the more promising sorts were saved, so that larger areas have now been planted, and seeds have been sent to several of the other stations. During the present year 367 species have been planted, and although many of them, as was to be expected, have proved to be of little value for this locality, there are a number of them which appear so well suited to the climatic and soil conditions of the Gulf States that their areas are being increased as rapidly as is possible. The work with many of these species has now been continued through three seasons, and on sufficient areas to give strong indications of their permanent value. A description of the more important of these follows.

**COLORADO BLUE-STEM** (*Agropyrum glaucum*).—Of the six Western species of *Agropyrum* which have been tested here this is decidedly the best, though it has not grown so vigorously and satisfactorily as it does on the Western plains. It bears drought well, and makes one cutting of inferior hay, but its principal value here will be as a part of a mixture for a permanent pasture. From the excellent growth which this grass is making at the Garden City Station and at places in New Mexico and Texas we had hoped that it might be of value here, but so far we have seen little to recommend it for the Gulf States.

**JAPANESE RYE** (*Agropyrum Japonicum*).—In its general habit this is much like fescue-grass (*Bromus Schraderi*), but does not grow as large and the heads are somewhat bearded. It will grow later in the season, however, and propagates itself more readily from seeds on unplowed land, and is perennial. It is eaten readily by all kinds of stock, and appears to be a valuable species for mixing with other pasture grasses.

**AUSTRALIAN BLUE-GRASS** (*Andropogon erianthoides*).—This is a perennial species from Australia which has been cultivated in a few localities for a number of years and advertised to a considerable extent, but its growth has not been very satisfactory here. It is so tender that it barely lives through the winter in this latitude, and starts into growth very late in the spring, though it makes an excellent growth during the summer, and will give two fair cuttings of fine, tender, and nutritious hay. The leaves are killed by a moderate frost, and it fails to hold the ground against the encroachments of other grasses. Several other species of *Andropogon* from Australia and from India have also been tested, but this appears to be the best of the



genus and the only foreign one which makes any promise of final success.

**SMOOTH BROME** (*Bromus inermis*).—This is also nearly related to the fescue-grass, but endures the summer heat and drought much better and will grow on a much harder and poorer soil. It produces a great amount of long and tender leaves near the ground, while the culms are rather slender and are not produced in very great abundance, so that it is better fitted for grazing than for hay. It is one of the few species which remains green through the entire year and bears grazing well. One plat of this was sown three years ago and, so far, it has held the ground to the complete exclusion of all other grasses and weeds.

**STAR-GRASS** (*Chloris Swartziana*).—This is a perennial species which is found growing wild near the coast from Florida to Texas, and which has grown remarkably well in cultivation in central Mississippi. It propagates readily from seed, and sends out runners from 1 to 2 feet in length, from each joint of which a cluster of long, tender, and succulent leaves is produced. It bears frost well, and the leaves grown in October and November remain green and fresh until February, thus making it an excellent winter pasture. It does not bear tramping as well as do some others, and does not grow sufficiently tall for hay, but there are very few species which will yield as much good pasture as will this during December and January.

**INDIAN BEARD-GRASS** (*Chrysopogon serrulatus*).—This is a perennial grass, the seed of which was received from India, and which is one of our most valuable importations. Although nearly related to our native "broom-sedge," it starts into growth much earlier in the spring, produces a heavier growth of leaves, and will yield two cuttings of excellent hay, besides a considerable amount of winter pasturage. It has been entirely free from any injury from cold and from all attacks of fungous diseases, and is spreading well by self-sown seeds. It grows from 4 to 5 feet high, and more than one-half the weight of the hay is made up of the leaves, the stalks being rather small. We have saved all the seeds we could collect of this species, and have distributed them to the other stations for further trial.

**CRESTED DOGSTAIL** (*Cynosurus cristatus*).—This grass has been very highly recommended in Europe and in the northern States, but it has been of no value here. Although it has been sown at six different times, and on a variety of soils, during the last three years, and has never failed to germinate, we have found only two plants which matured seeds, and all the plants from every sowing have now disappeared, having been killed by very moderate droughts.

**AFRICAN MILLET** (*Eleusine coracana*).—The seed of this grass was procured from France, where it is highly recommended as a "quick crop." It was sown here in 1888 for the first time, when it grew finely and matured a heavier crop of seed than did any other grass. It grew about 2 feet high, with very large, flattened, tender, and succulent stems, which are well covered with leaves. The seeds are produced in heads similar to those of the common "crowfoot" grass, but are very large, usually about one-tenth of an inch in diameter, and single heads sometimes weigh over 2 ounces. It matures by the end of May, and, as it is an annual, the ground can then be used for other purposes. It does not bear pasturing well, and the seed grown here does not seem to produce as vigorous plants as were grown from that which was imported. It grows more rapidly and ripens earlier than does the common millet, but seems to possess no other advantage and makes a smaller yield.

**TEFF** (*Eragrostis Abyssinica*).—This is one of the several species of



“love-grass” which have been received from India and Australia, and which has been very highly recommended for both hay and pasture, especially in India. Here, it has grown about 2 feet high the first season, making one good cutting and a second lighter one of excellent hay. It is an annual, and the seed grown here seems to be lacking in vigor, the growth of the second and third years being too small to make the species desirable for general cultivation.

**SLENDER LOVE-GRASS** (*Eragrostis parviflora*).—This is from the same countries and appears much better suited to our climate, growing fully 3 feet high, with very slender culms and an abundance of leaves. Although an annual, it reseeds the land freely, makes excellent hay, and is one of the best of the genus for this locality.

**EVERLASTING GRASS** (*Eriochloa annulata*).—This is a perennial in Australia, its native country, but here it barely survives the winter, and a large part of its spring growth comes from seed which were scattered on the ground during the previous season. It starts very early in the spring and grows rapidly, reaching about 2 feet in height, and producing a large number of slender culms, which are well covered with leaves, and an abundant supply of seeds. It can be cut at least three times, bears pasturing well, and makes excellent hay. Mr. Turner, botanist of the Australian department of agriculture, says this is “a superior pasture grass, found in the coastal districts and in the colder parts of the colony. It will grow and furnish feed nearly all the year round in the coastal districts, but during early summer months it yields a great amount of rich, succulent herbage, greedily devoured by stock of all kinds. This grass is worth the attention of dairy farmers.”

**TEOSINTE** (*Euchlaena luxurians*).—Although this has been before the public for many years, it has not yet attained the popularity which it deserves in the Southern States. It is a remarkably vigorous grower, reaching 10 or 12 feet in height, with an unusually abundant supply of leaves and very slender stems, which continue to grow until killed by frost. If cut when it reaches 4 or 5 feet in height it makes excellent hay, and will produce a second crop fully as large. If left to grow until September or October it furnishes the very best of material for the silo, and a greater amount per acre, than does either corn or sorghum, and we have found no other plant which is its equal for soiling purposes. Its season of growth is so long that it seldom matures seed north of latitude 30°, but it ripened well last year at the Louisiana Station.

**VELVET GRASS** (*Holcus lanatus*).—This has been in cultivation here for many years, but has never been as satisfactory as it appears to be in some other localities. When young it is very easily killed by drought, and in wet seasons it suffers severely from the attacks of a rust (*Puccinia coronata*), which is frequently so abundant as to kill the plants when they are about ready to bloom. When the grass becomes well established, and escapes the rust, it is fairly permanent on very dry and barren soils, affording a considerable amount of good grazing or a moderate cutting of hay early in the summer, but on rich soils it is soon crowded out by other species and, in this region, can be recommended only for mixing with other grasses for pasture lands.

**MANY-FLOWERED MILLET** (*Oryzopsis membranacea*).—This is a perennial species from the Western plains which makes a vigorous growth, producing leaves 2 feet or more in length and culms 3 feet in height. The leaves, however, are quite tough and wiry, and the stems very hard and woody, so that it would be regarded as being practically worthless were it not for its ability to withstand the most severe droughts, and



the fact that it remains green through the winter. It possesses these two characteristics to an unusual degree, however, and we shall plant it more largely in the future.

MUNRO GRASS (*Panicum agrostoides*).—This grass has been in cultivation to some extent for fifteen years, and is valued highly wherever it is known. It requires a rich soil, on which it grows 3 or 4 feet high, produces an unusual amount of leaves, has tender and succulent stems, and bears drought well. Two crops of good, though rather coarse, hay can be cut during the summer, after which it should be allowed to mature seed. It is of but little value for winter pasture, but for hay and for summer and fall grazing it is the best of the genus. It grows spontaneously in all of the Southern States, usually being found along creek banks and on the borders of ponds, and seed can be saved with very little trouble.

PARÁ GRASS (*Panicum barbinode*).—This is a perennial species which produces runners from 10 to 30 feet in length, with an abundant supply of leaves and upright branches, and yielding an immense amount of forage. It does not mature seed in this latitude, but the roots live through the winter, and the new growth is ready to cut by June 1, and will yield a good cutting once in six weeks from that time until the end of the season, though it should not be cut after October 1, in order that it may have time to produce a crop of leaves to serve as a winter protection for the roots. This is of considerable value for the region near the coast, but is too tender to be recommended for localities subject to severe frosts. *Panicum spectabile*, from southern Europe, is very similar, but is rather coarser, and does not appear to be relished as well by stock, though it bears more cold.

INDIAN MILLET (*Panicum frumentaceum*).—In India this is cultivated largely for its starchy seeds, which are used for food, but it has not succeeded well here. On rich soil it makes a small crop of hay early in the season, but makes no second growth, and must be seeded annually like the German millet. If sown late, the seed does not mature before hot weather causes it to blight, and on poor soil it seldom reaches over a foot in height. It is in every way inferior to the German millet.

SWAMP PANIC (*Panicum gibbum*).—This is one of the many native species of *Panicum*, and is found wild from Carolina to Florida and Texas. It usually grows in swampy soils, where it often reaches a height of 6 feet, but will also grow well on uplands, and spreads rapidly by seeds and by runners. It starts with the first warm days of spring and continues its growth, even in severe droughts, until killed by heavy frosts. It produces more seed than does any other native *Panicum*, and, as the seed is produced continuously throughout the season, it is of unusual value for both hay and pasture. At this time, October 15, when clover and orchard grass are both nearly dead from a drought of two months, this is green and flourishing.

SPREADING PANIC (*Panicum proliferum*).—While this grass prefers a damp soil, it will also grow well on dry uplands, and as it makes its best growth in late summer when other species have been killed by drought, it is well worth cultivating. It continues to grow until killed by frost, and, while rather coarse for hay, it makes excellent pasture, and cattle prefer it to almost any other grass during its season. When pastured too closely stock will prevent the maturing of seed, but with moderate grazing it will reseed itself freely.

TEXAS MILLET (*Panicum Texanum*).—This is much like the swamp panic, but larger and coarser in every way, and although an annual, it



reseeds itself freely and holds the ground well against other grasses and weeds. Mr. Lea, of Texas, says:

I consider it far superior to any grass that I ever saw for hay. It is a much more certain crop than millet, and cultivated with less labor, and all kinds of stock prefer it. In this region it is regarded, in the condition of well-cured hay, as more nutritious than any other grass. It grows only in cultivated ground; it prospers best in the warmest season of the year; its luxurious growth subdues other grasses and some weeds.

With us it has not covered the ground as closely as has the swamp panic, and the stems are rather coarse for the best quality of hay. It also starts later in the spring, but bears drought equally well, and makes a heavier growth late in the season.

**BLUE CANARY-GRASS** (*Phalaris cærulescens*).—A perennial European species which, in manner of growth and quantity of hay, is much like timothy, but is far better suited to the Southern climate. Here it is usually ready to cut about June 1, the culms being then from 4 to 5 feet high and well covered with fresh leaves. The yield of hay is very heavy and of the best quality, but no second crop is produced. It bears grazing much better than does timothy, but its chief value lies in its hay-producing qualities. As it matures at the same time as does red clover, it will be of value for sowing with it, as timothy is used in the Northern States. Most of our seed has been imported from France, and we have had difficulty in making it germinate, but the American-grown seed has done much better in that respect.

**SORGHUMS** (*Sorghum vulgare* vars.).—A large number of varieties of sorghum have been grown, the best of which appears to be the "Kaffir branching" variety. This has grown about 12 feet in height, and is similar to the common sorghum, but produces a much heavier yield of seed, and so is of more value for forage. It branches very freely from the upper joints, single stalks often bearing as many as fifteen heads of seed. If cut early it will have fewer heads, but has more green leaves, and the stalk is less dry and pithy than if cut late. This has been the best of the cultivated varieties, though the "rural branching" and the "yellow branching" have done nearly as well. The two latter varieties are almost identical, and both are valuable, especially for soiling purposes, as they make a rank second growth after cutting, even late in the season. Neither grows more than 6 or 7 feet high, and both have stalks which are large and coarse, but are unusually well covered with leaves. While they are superior to the "Kaffir" sorghum for soiling, their total yield of both seed and forage is less.

There is a variety of sorghum commonly known as "chicken corn" which has become thoroughly naturalized in a few counties of eastern Mississippi and western Alabama, and which is a valuable addition to our hay-producing crop. In general appearance this sorghum is much like the ordinary broom corn, though the heads are less spreading, and the stalks usually branch at several of the upper joints, so that each bears a number of heads. It is usually most abundant in cornfields, where it starts into growth late in the summer, after the crop has been laid by, but grows rapidly and in September the corn in many fields is entirely hidden and the field appears as though planted with the common sorghum. If cut before heading it makes excellent hay and, on rich land, will produce a heavy second crop. If allowed to mature, the yield of seed is about the same per acre as is that of the ordinary cultivated varieties and is worth about as much for stock feed. The seed can be gathered at an expense of 10 cents per bushel, and many planters now make a business of saving it to use in the place of corn, though



it is somewhat difficult to keep on account of the attacks of weevils. It has one serious fault, which is that it is unsafe to permit stock to feed upon it when making a rank second growth late in the season. At that time it is often fatal, and sometimes so within a few minutes. It seems to affect only certain animals, or perhaps only certain plants produce the ill effect, as generally only a few animals in a herd are killed, and these are commonly found very near together. The plant is said to have been noticed here first about twenty years ago, and it is doubtless descended from some of the many varieties of sorghum which were brought to this country from China. The area which it now occupies is probably not more than 200 miles in diameter, being confined mostly to the "black-prairie" region, but it is spreading slowly, and will doubtless soon be found in other localities also.

**SACCATONE** (*Sporobolus airoides*).—This is one of the perennial Western species, which is much like the "many-flowered millet" in producing an immense amount of slender, tough, wiry leaves, which endure the most protracted droughts without injury and remain fresh and green during the winter. It is worthless for hay, but is certainly a valuable addition to our pasture varieties.

**BEGGAR-WEED** (*Desmodium molle*).—This plant requires close attention to be of value, but when properly treated it has been one of our most profitable forage plants. The soil for it must be rich, and should be moist rather than dry; the ground must be well prepared, and planting postponed until there is no danger from heavy frosts. The plants grow rapidly and should be cut when not more than  $2\frac{1}{2}$  feet high, as, if allowed to grow taller, the lower leaves drop and the stalks become too coarse for hay. It will give at least three cuttings in a season, and, as the roots go very deep, it is a renovating rather than an exhausting crop. Cattle are very fond of it, but it bears grazing only moderately well and does not reseed itself well on uncultivated ground.

**WINTER VETCH** (*Lathyrus hirsutus*).—There are two distinct varieties of *Lathyrus*, both of which are known in this country as "hairy vetch," but as one of them makes its best growth during the cool months of winter and the other during the warmer months of summer, it seems better to adopt the French names of "winter" and "summer" vetch. The winter vetch is sown in September or October, so that it may germinate with the fall rains and secure a root-hold before very cold weather. It will grow slowly for a few weeks, but about the 1st of January the roots are sufficiently developed so that the tops begin to grow rapidly, and by February the plants form a dense mat from 1 to 2 feet deep, and continue to grow until hot weather. The plants bear grazing well, and stock of all kinds eat the dry hay greedily. For the Gulf States this is by far the most valuable of the many species which are sold under the general name of "vetch," making a heavier growth, being eaten more freely, and reseeding itself more fully.

**BURR CLOVER** (*Medicago maculata*).—This plant is well worth cultivating in all of the Gulf States, and is growing in favor with those who have tested its merits. It is essentially a winter grower, being at its best from February to May, after which it ripens its seed and soon disappears. Stock which are unaccustomed to its use do not always like it at first, but all soon learn to eat it, and many seem to prefer it to any other plant. It is an excellent plant for sowing on Bermuda land, as it matures its seed and dies at about the time the Bermuda starts into growth, and when the latter is killed by frost the clover soon takes its place. A mixture of these two plants comes nearer giv-



ing continuous pasture than does any other mixture which we have tested.

CRIMSON CLOVER (*Trifolium incarnatum*).—This has attracted great attention in the South during the past three or four years, but its true merits are still in doubt. So far it has not given a good crop at the Mississippi Station, though it is valued highly at the Carolina Station, and at the Florida Station has given one immense crop, followed by two failures. Under favorable circumstances it makes a very vigorous winter growth, and affords good grazing or soiling, but in many cases only a scattering stand is secured and the plants are weak and sickly. It can not be recommended for general use until more is known of the conditions necessary to its success.

#### CHARACTERISTIC VEGETATION OF THE DESERT REGION FROM WESTERN TEXAS TO CENTRAL ARIZONA.

By L. H. DEWEY, *Assistant Botanist.*

In June (1891) the writer spent about ten days in the country between Del Rio, Tex., and Phoenix, Ariz., traveling on the Southern Pacific Railroad, and stopping at El Paso, Tucson, and Maricopa. The following notes are based on observations made from the car windows, or while wandering about in search of plants at the places visited. The summer rains usually begin in the higher elevations near the last of June, so that the desert was seen at its driest time, at the end of the spring dry season.

The soil throughout the region was as dry as a hot sun and a dry wind could make it. But little water was found anywhere away from the rivers, and even these often had a dry and thirsty look. As there was very little moisture outside of the irrigated regions, the atmosphere was very dry and evaporation consequently rapid. These conditions of dry soil and rapid evaporation, with a change twice a year, especially in the higher altitudes, caused by heavy rains, explains many of the curious forms of vegetation.

The topography of the country is doubtless another important factor in determining the kinds of plants which have survived there. The entire region is broken by mountain ranges rising from 1,000 to 4,000 feet above the general level. Between these ranges the valleys are generally quite level, showing a noticeable absence of hills and hollows, which are so abundant in the glacial region. The soil varies from coarse crumbling granite to sand and clay. It is generally somewhat alkaline. I shall describe only the vegetation of the uncultivated and unwatered desert, for the irrigated tracts are by no means parts of the desert. Del Rio, Tex., was the first station visited west of the one hundredth meridian. The land here slopes gradually up from the bluffs along the river, the soil being mostly sandy. The woody plants most noticeable here are the mesquit, *Parkinsonia*, *Ceanothus*, and *Rhus*.

Mesquit (*Prosopis juliflora*.)

(Plate I.)

The mesquit (mēs-kēt'), which is most abundant, is one of the characteristic shrubs throughout the entire desert, and even extends beyond its limits as far east as Austin. It varies in size from a straggling bush 2 feet high to a well-formed tree 50 feet high with a trunk 2 feet in diameter. Away from water it seldom becomes much of a tree. It is of



such slow growth that it is almost impossible to count the annual layers. The wood is very hard and brittle, and it is commonly said that it is easier to break it with the back of the ax than to cut it with the blade. It forms the chief wood supply of the region. In the streets of San Antonio it makes probably the finest wood pavement in the country. Near Phoenix I saw several cords of it piled up to run an engine at a gold mine. This wood was cut 3 feet long, and cost \$3.75 per cord. Where the sand blows these mesquit bushes cause it to drift about them, often making mounds 4 or 5 feet high with a few twigs of the bushes still alive and projecting out at the top. Inside of these mounds there is a dense growth of roots and buried bushes. There is very little shrubby growth above ground in these regions of drifting sand, and the people mine in these mounds for fuel. The fruit of the mesquit or mesquit beans are prepared in various ways for food.

*Parkinsonia Texana.*

The *Parkinsonia* found at Del Rio is a shrub about 2 feet high with abundant thorny green branches, looking like lilac sprouts with the outer barks peeled off. A few yellow flowers were to be found on the bushes in June, but the small leaves which the plant has during a few weeks of the rainy season were about all gone, and an entire bush could not cast shade enough to keep a lizard out of sunlight.

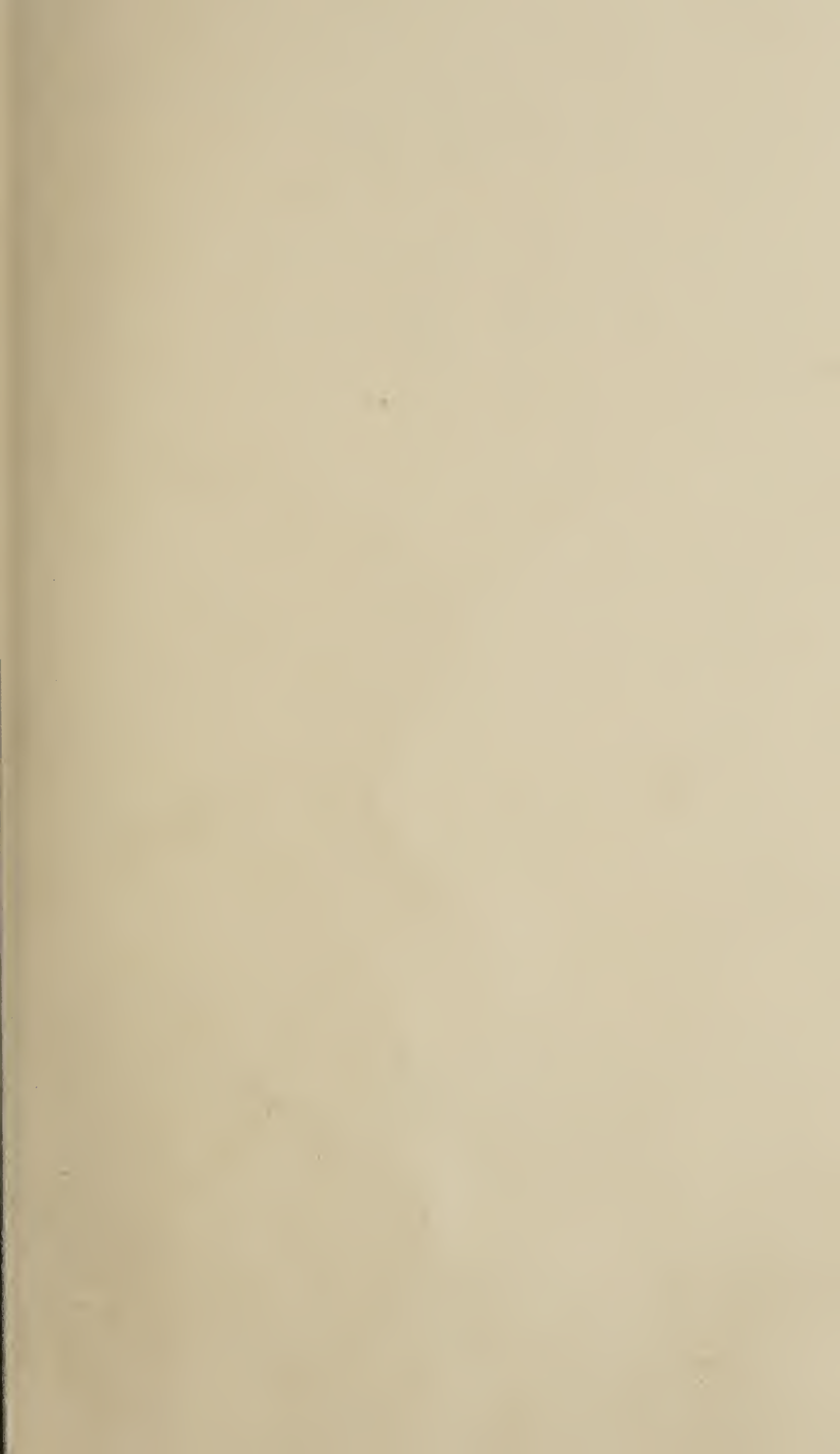
*Ceanothus Fendleri.*

A *Ceanothus* was found here, about a foot in height, that almost rivaled the *Parkinsonia* in illustrating the compactness of vegetation where evaporation is to be contended with. The stems of the *Ceanothus* were thickly crowded with spiny branchlets an inch long or less, and these in turn were pretty thickly crowded with nearly sessile round leaves scarcely three-eighths of an inch in diameter.

*Rhus microphylla.*

A bush less abundant than the others mentioned, but a little taller, is a species of sumach (*Rhus microphylla*). This bush has grayish bark and, as the name indicates, rather small leaves. It was quite attractive when I saw it, being well filled with small red berries, which are more pleasing to the sight than the taste. Very little grass was to be found on the dry land. There was nothing like a close green sod except in a few well-watered dooryards, where Bermuda grass had been introduced. Here and there was a little stool of *Aristida*, and there were scattered patches of withered grass showing that a *Bouteloua* (white grama-grass) had been quite plentiful in the rainy season. On the irrigated land I saw a pretty good crop of hay being cut. It was mostly brome-grass, called there Texas blue-joint (*Andropogon saccharoides*). Johnson grass (*Sorghum halapense*) flourishes on the irrigated lands to an extent that is quite vexatious to cultivators. From Del Rio to El Paso, along the Southern Pacific, the region is scarcely a part of the desert proper. The railroad winds about most of the way through a broad valley 3,000 to 5,000 feet above the sea level. The landscape in June had generally a gray appearance, due to a rather thin growth of an almost woody species of grass (*Hilaria Jamesii*). This is one of the Gietta grasses, although sometimes improperly called black grama. It grows in small bunches a foot high or less, and at first sight appears to be dead, but it is alive and waiting for the next rainy season to get







a drink to grow on. It is very nutritious, and furnishes a large part of the forage for the thin cattle that seek pasture here. Some of the true grama-grasses (*Boutelouas*) are found here also. The gray background is dotted here and there, often quite thickly, with the dark green of the yucca, or the lighter green of the prickly-pear cactus. Two forms of yucca are common in these high valleys. One has sharp-pointed stiff leaves, about 18 inches long, projecting out from the base, and a stalk 5 to 10 feet tall, bearing large spreading panicles of cream-colored flowers.

Spanish bayonet (*Yucca baccata*).

(Plate II.)

Two or three species of yucca are called Spanish bayonet. The most abundant form here has a thick stalk about 3 or 4 feet tall, bearing sharp-pointed leaves at its top which project in all directions. From the center of this leaf-cluster arises the flower-bearing stalk, seldom more than 3 feet long, and bearing a more compact cluster of creamy white flowers. These yuccas, as well as the cactus, owe their present existence in this region to the fact that their juicy edible parts are so well protected that even a Texan steer must starve before obtaining much nourishment from them. The cactus is fed to cattle after the spines have been removed by fire or otherwise.

El Paso, on the Rio Grande, is about 3,700 feet above sea level. The soil here varies from adobe clay near the river to solid rock up at the top of Mount Franklin, 3,000 feet above the river. The intermediate steps are coarse sand, gravel, and broken rock which bears no evidence of being waterworn by even an artificial shower. In the adobe soil are found a species of *Baccharis*, an almost shrubby composite; a small flowered aster (*Aster spinosus*), with smooth green stem, armed with sharp spines, but with few leaves, if any; a low-spreading *Sphaeralcea*, with bright orange-colored flowers, and many other species less abundant. Vegetation is nowhere dense, however, except at the very edge of the muddy river or along the irrigating ditches. In the sandy soil back from the river there is a thin growth of bushes—mesquit, creosote, and acacia. These each make a thin straggling growth of about 2 or 3 feet out of the top of the little sand hills which surround them, and altogether cover perhaps one-twentieth of the ground, which is nearly barren of anything else. A few composites grow here, most noticeable among them the bright yellow-flowered *Riddelia arachnoidea* and *R. tagetina*.

Creosote bush (*Larrea Mexicana*).

(Plate III.)

The creosote bush is one of the most typical plants of the desert; for it is found throughout the desert and, unlike the mesquit, nowhere else, not even in the oases. It is a sticky, resinous bush, with small round evergreen leaves, yellow flowers, woolly fruit, and a very strong disagreeable odor, which is suggested by its name. It is reported to have valuable medicinal properties, and is used to some extent in the mining camps as a "cure all" for both man and beast.

Acacia bush (*Acacia constricta*).

(Plate IV.)

This is the most abundant acacia found here, but three or four others are not uncommon in the desert. They are mostly low spindling bushes,



of little if any value except to give a little touch of green to the landscape. They have small leaves and very small yellow flowers in dense spherical or cylindrical heads. The *Acacia constricta* is well distinguished by the slender pods, 3 or 4 inches long, constricted between the seeds.

Vine cactus or candlewood (*Fouquieria splendens*).

(Plate V.)

On the hillsides in the coarse gravel is found the vine cactus. This is not a cactus, but its appearance gives it its name. The plant consists of from one or two to half a dozen stalks about an inch in diameter, nearly straight, and about 5 feet tall. The stalks are gray in color, armed with abundant spines, and bearing comparatively few small green leaves. At the top of the stalks are one or more clusters of orange-colored flowers or fruits. These plants, as insignificant in appearance as the mullein stalks in the East, serve many useful purposes. Set up in line close together they make a living hedge that even a jack rabbit can not pass, and many yards and gardens are fenced in this manner. Set more closely in line around a rectangle 5 feet wide and 10 feet long, with an opening at one end and a covering of brush over the top, they make a complete house for a family of Mexicans of the poorest class.

Growing in the same locality as the *Fouquieria*, and still farther up in the rough broken rock, is an Agave (*Agave heteracantha*), bearing a beautiful spike of light yellow flowers with long purple filaments and large yellow anthers. Several species of cactus are found in the rocky soil from the upper limit of the *Fouquieria* to the top of the mountain. These are mostly flattened or nearly spherical species of *Mammillaria* or *Cereus* from 1 to 6 inches in diameter. At the top of Mount Franklin a few small shrubs are growing in the crevices of the rocks, and also a rather rare grass (*Scleropogon karwinskianus*), which, together with an *Aristida*, furnishes a scanty pasture for goats. From the top of Mount Franklin one may see the country for miles around in all directions, and it looks pretty barren. No timber is to be seen anywhere. A strip of green marks the Rio Grande, but aside from this the general color is that of the yellow sand. The region of high valleys in southern New Mexico through which the "Sunset Route" passes from El Paso to Tucson is to a great extent very similar to that in Texas between Del Rio and El Paso. Some of the region in southeastern Arizona, however, is much broken with rocky and gravelly hills, resembling somewhat those back of El Paso. Here we find several species of century plants, one of the most prominent being *Agave Parryi*.

Amole (*Agave Parryi*).

(Plate VI.)

This has a cluster of thick spiny-margined leaves, from which arises a stem an inch or two in diameter and 8 to 12 feet tall, bearing at the top a showy panicle nearly a foot wide and three times as long, of creamy white flowers. Such plants in the Eastern cities would be worth a small fortune apiece. Here they grow wild and luxuriant and are almost unnoticed. At Tucson we have conditions and a vegetation similar to those of El Paso. There are a few Arizona additions, however. Several forms of cactus here were not seen in Texas.



Giant cactus (*Cereus giganteus*).

(Plate VII.)

This cactus grows here, but it is more abundant along the railroad farther west and along the branch from Maricopa to Phoenix. It is by far the largest form of vegetation in the desert. Specimens 12 to 18 inches in diameter and 20 to 40 feet tall are not very uncommon, and even larger ones may be seen. This peculiar plant usually consists of a coarsely ribbed, spiny, cylindrical column, tapering at the top and bottom, and bearing from one to half a dozen ascending branches. Every plant seen was scarred, often in many places, where thirsty travelers had cut holes in the rind to obtain the juice.

Another noticeable species of cactus (*Opuntia arborescens*) grows in a much branched and bush-like form and is thickly clothed with light-colored spines.

Palo-verde (*Parkinsonia Torreyana*).

(Plate VIII.)

This very peculiar naked evergreen tree, 20 feet high or more, is found here. It has small green leaves in the rainy season, but these soon drop off and the smooth, light-green surface of the entire tree makes it appear as if stripped of bark as well as leaves. In the dry season very little grass is to be seen, except upon close examination. One little plant 2 or 3 inches high, which will be picked up for a grass and dropped more quickly for a thistle, is quite abundant in the sand. It is *Triodia pulchella*, a grass with short, rigid, sharp-pointed leaves and an almost sessile panicle of spikelets, which are white and woolly.

Gietta grass (*Hilaria rigida*) is another desert grass of more importance, for it aids materially in furnishing forage. It grows in clumps a foot or more in diameter, and is coarse and woody, but very nutritious. Its woody character prevents its being killed by too close cropping or by tramping, as is the case with the grama-grasses found here.

*Sporobolus airoides* and *Sporobolus Wrightii* are two very coarse perennial rush grasses, growing in bunches, and where there is some moisture in the soil.

Without irrigation there is apparently but little hope of success in agricultural pursuits in the desert except in grazing, and overfeeding is spoiling the ranges for that industry. With irrigation the agricultural possibilities are almost unlimited, as proved by the fruits, crops, and cattle raised in the Salt River Valley.

**TWO WEEDS NEW TO THE UNITED STATES.**By J. N. ROSE, *Assistant Botanist.*

The attention of agriculturists is here called to the introduction of two plants which promise to be common pests. Both plants are spreading rapidly and are giving farmers much trouble wherever they have gained a foothold. While these weeds seem to have come to stay, yet nothing definite can be stated. Weeds are sometimes introduced, which spread rapidly for a few years, and then as rapidly disappear, and it is to be hoped that such may be the case with these.

The following descriptions will be of aid in identifying these two species:



## ORDER OROBANCHACEÆ.

Branched Broom-rape (*Orobanche ramosa*).

(Plate IX.)

An annual plant, 6 to 15 inches high, with many slender branches of a brownish or straw color, more or less hairy, parasitic upon the roots of other plants. Small, colorless bracts, instead of leaves. Flowers scattered in long, slender branches; flower stalk very short; bracts three, one larger at the base of the flower stalk, two smaller at the base of the flower. Calyx 4-toothed, split on the back. Corolla light blue, 2-lipped; lower lip 3-lobed; upper-lip notched. Stamens 4. Style 1, with a broad 2-lobed stigma. Ovary 1-celled. Seeds minute, very numerous.

This plant is a native of Europe, and has only been known in the United States about five years; it is very rapidly spreading, and it is feared that it may prove a most injurious weed in this country. The attention of this Department was first called to this plant in 1889, and, from reports since received, it is rapidly spreading. It was first seen in Kentucky, where it proved very destructive to hemp and tobacco. About three years ago it was introduced into Iroquois County, Ill., and has increased rapidly. It is very destructive, particularly to hemp and tobacco, as it fastens itself upon the roots of these plants and draws from them their substance. Its growth in this country is more rank than in Europe, and it will doubtless be more of a pest here. When it once gets into a field it is very hard to eradicate, owing to the great multitude of seeds which it produces. The only remedy is to plant other crops for a few years, and by all means to be careful to obtain pure seeds from uninfested regions.

## ORDER CHENOPODIACEÆ.

Saltwort (*Salsola Kali* var. *Tragus*).

(Plate X.)

Plant annual, robust. Stem much branched, spreading, very variable in size, often 4 to 6 feet high, glabrous. Leaves alternate; the earliest leaves filiform, 1 inch long, with a spiny tip; upper and floral leaves small, awl-shaped, much broadened at base, with a strong spiny point. Flowers very small in the axils of the leaves, subtended by two leaf-like bracts. Sepals 5, oblong, acute, glabrous, with a short wing or thick margin near the middle. Stamens 5. Styles 2. Seeds 1 with a coiled embryo.

The *Salsola Kali*, or common saltwort, is a native of this country, growing along the sandy seashore from New England south to Georgia. Although one of the earliest plants known in this country, it has never spread into cultivated fields or become a troublesome weed in any of the Eastern States.

The variety *Tragus* is not known to be native in this country, but its home is in Russia, and it has more than likely been introduced from that country either with forage seed or brought over in some way by emigrants.

However it may have become introduced in the West, one thing is certain, and that is that it is rapidly spreading and threatens to be one of the very worst weeds with which the farmer will have to contend. It has already gained a strong foothold in North and South Dakota, extending eastward into Minnesota and Wisconsin, and is common in northern Nebraska, and has been recently detected along railroad tracks near Denver, Colo. Some systematic and vigorous steps should be taken by the farmers of these Western States to eradicate this weed.



In Nebraska a bill was introduced in the last legislature with this end in view, but it failed of final passage. Some such action by the other States is to be commended.

This weed is called throughout the Northwest both Russian cactus and Russian thistle, although it is not properly a cactus nor a thistle. The attention of this Department was not called to this plant until the present year, although it is said to have been seen in this country for four or five years past. It is rapidly spreading over the Dakotas, and will become a most dangerous pest to the farmers unless its progress is in some way checked. This weed is a rapid grower and soon takes entire possession of neglected fields. It is an annual, and with careful and timely cultivation it can easily be exterminated. The Dakota farmers are much troubled by it, as it comes up after the wheat is cut and, overrunning the fields, it blossoms and matures seed for another year. In such cases early plowing is recommended, as then the young plants may be turned under and killed; then care should be taken that plants are not allowed to mature seed in waste places. This plant acts as a tumble-weed in the fall and winter, and in this way scatters its seeds over a wide territory. Mr. Norman S. French, of Grand Rapids, N. Dak., to whom this Department is indebted for first sending us specimens of this weed, writes:

This weed was first seen in this vicinity about four or five years ago. It was observed around the stock yards of the Milwaukee and St. Paul and Chicago Railroad at Ellendale and Monango, in Dicky County, and at Edgeley in this county, (La Moure). Intelligent Russians have told me that the weed grows abundantly in southern Russia, in the vicinity of Odessa, where it is locally known as the Tartar thistle, and it is supposed to have been brought to America by Russian Jews in some manner not known.

The points of the leaves in age become indurated and sharp pointed. This causes great annoyance to farmers, for in harvesting and fall plowing the legs of the horses are cut by them, even when protected by leather or rubber.

Mr. Warren Upham, assistant geologist, U. S. Geological Survey, writes to me under date September 23, 1891, as follows:

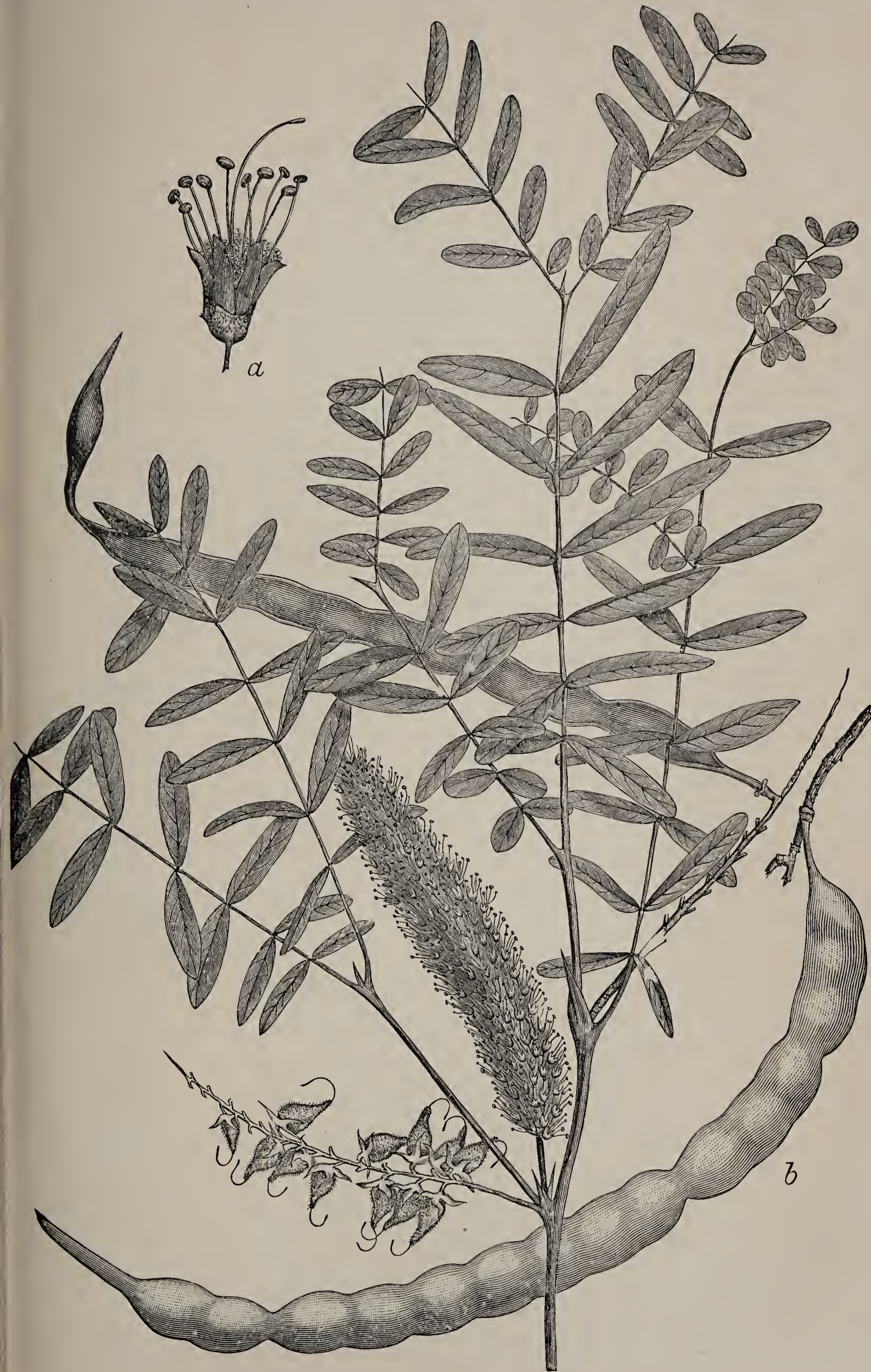
During my travels for geologic exploration in North Dakota in 1889 I saw your weed *Salsola* growing on a railway embankment near Clement, which is a few miles west of Oakes, and again as a weed on a sandy cultivated field of the Souris cottonland, near Towner. The habit of the plant resembles that of *Amarantus albus* L. It forms a stiff, prickly, rather compact, green bunch 2 to 3 feet in diameter and of hemispherical form.

S. W. Narregang, president of the Dakota Irrigation Company, writes, under date October 28, 1891, to the Department, as follows:

I send you herewith a fair specimen of the Russian thistle; it was impossible to obtain a perfect sample, because at this season the plant becomes brittle and breaks from the roots. I dug a small root and fastened it to the stock of the thistle. They grow much larger than the specimen, often three times as large, forming plants 6 feet in diameter—as large as a large wagon wheel. In reply to your question as to the time of its first appearance I would say that we first saw it three years ago. Since that time it has steadily increased, until at present the greater portion of South Dakota east of the Missouri River is infested with the thistle, particularly the strip of country extending from Eureka, Campbell County, southeasterly to Sioux Falls, which is covered thickly with this weed. This obnoxious weed has become so formidable in some portions of the State, notably in Scotland, S. Dak., where the Russians formerly settled, that many farmers are driven from their homes on account of it. A man who was there some time ago states that farmers were leaving their land by the dozens, simply because of this evil. As to the soil it affects, the plants are found in different soil, but thrive best in high dry places, railroads being the favorite position, and the poorer the soil the more vigorously it grows. It is also found growing abundantly in cultivated fields, springing up among crops that are being cultivated, especially in wheat fields, but not as much in cornfields, as there they have a

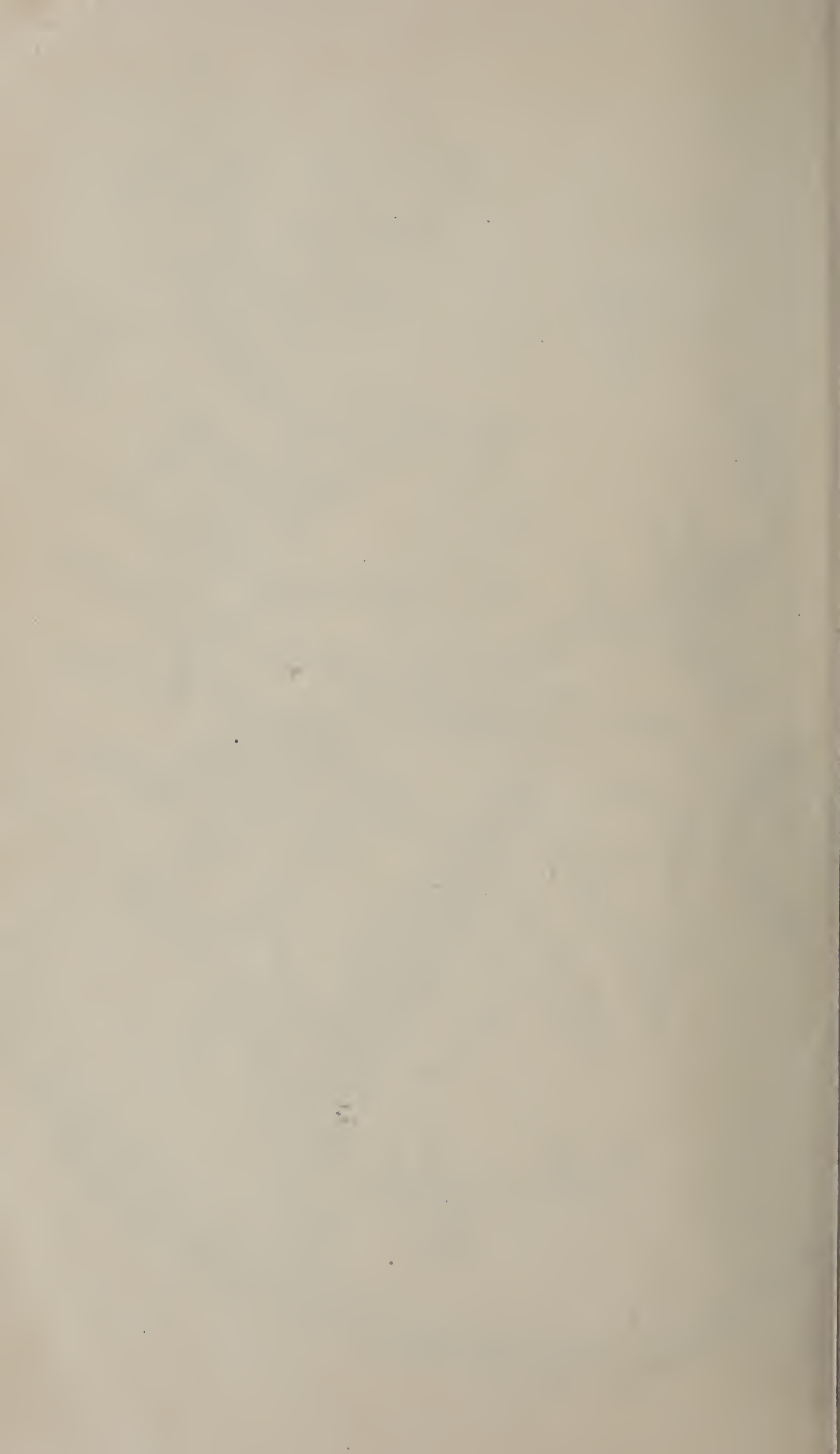
chance to kill the weeds as fast as they start. It is never found in low wet places, and very seldom on the unbroken prairie. The seed is similar to the old-fashioned tumble-weed, and as it has millions of seeds, any field where one of these plants has grown will be literally covered with the seeds. Plowing seems to have no effect upon it; perhaps summer fallowing might in a measure stop its growth. As these plants appeared during the last two or three dry seasons and do not thrive on low ground, it seems strong evidence that they will disappear when we get an ordinary and sufficient amount of rainfall. From the best authority I can obtain there is no question but that the Russians brought the seed to this country. It is claimed that the tender plants make good feed for stock; I have noticed that cattle and sheep eat them when the weeds are very young, but the plant grows quickly and in a short time the stalk becomes hard and then nothing will touch it. It is becoming a very serious question with our farmers how to free their land at this time, and unless some method is devised to stop its growth or exterminate it a great many acres in this country will become valueless in a very short time.





MESQUIT (*PROSOPIS JULIFLORA*).



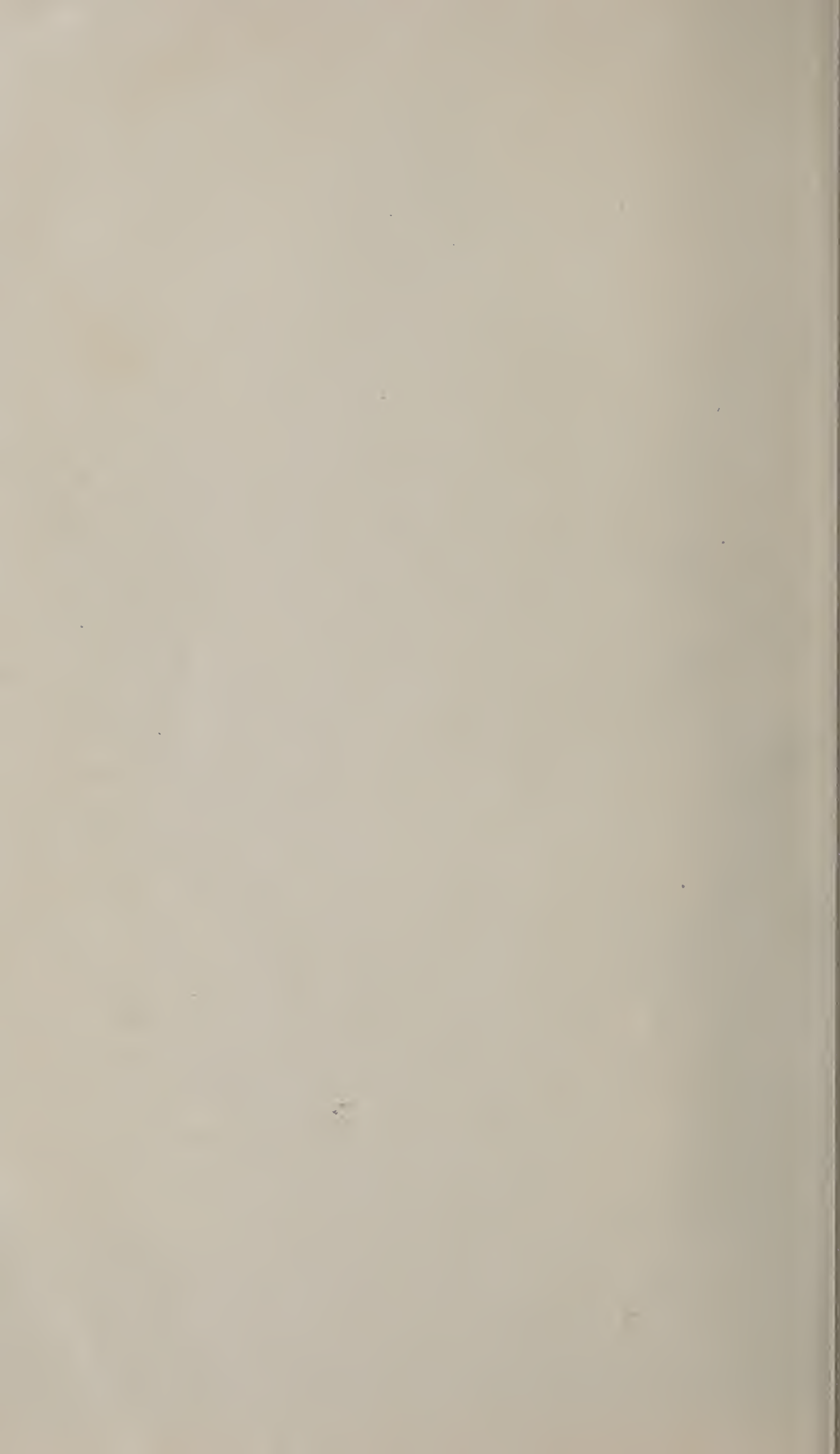




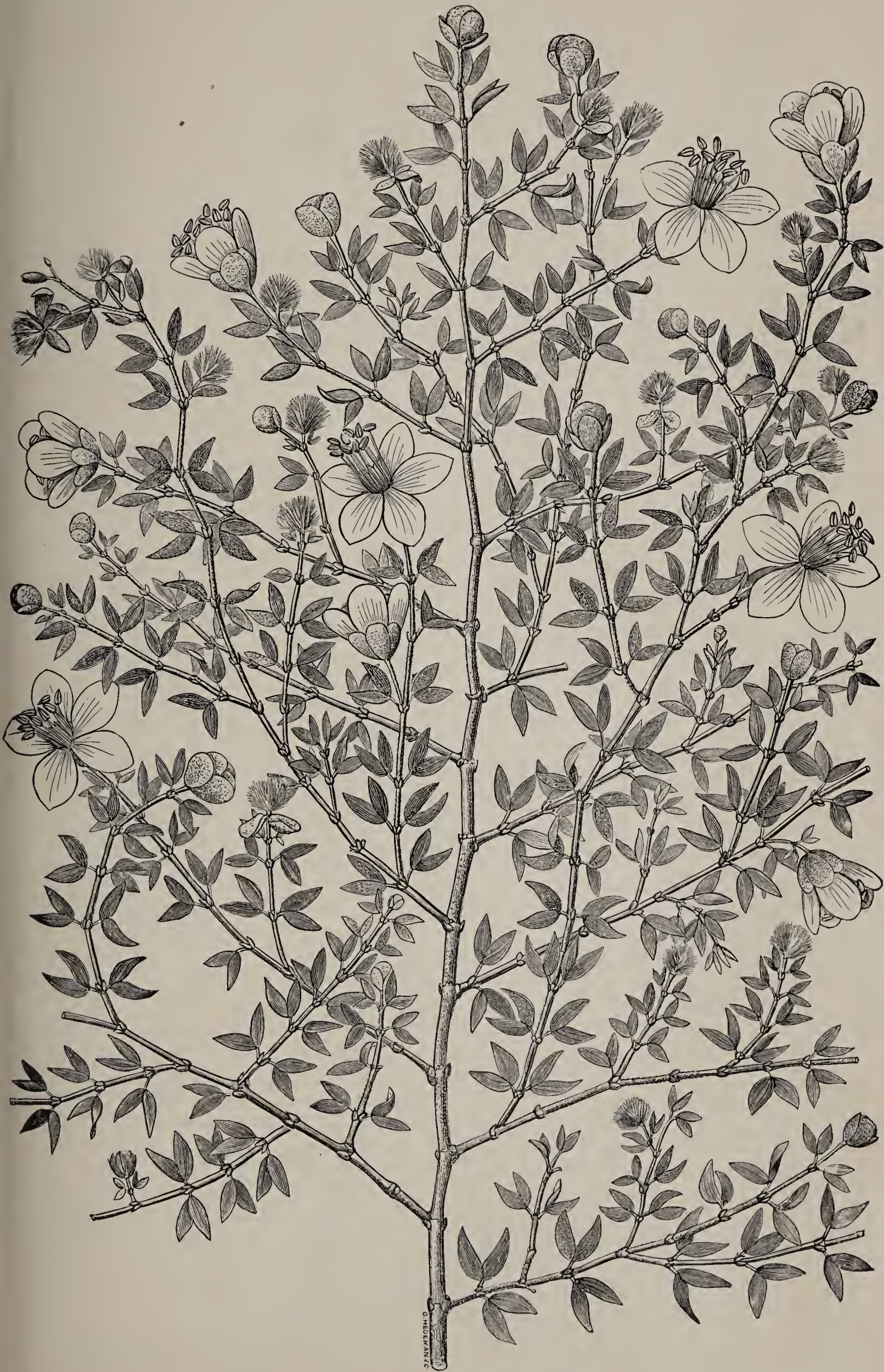


SPANISH BAYONET (YUCCA BACCATA).





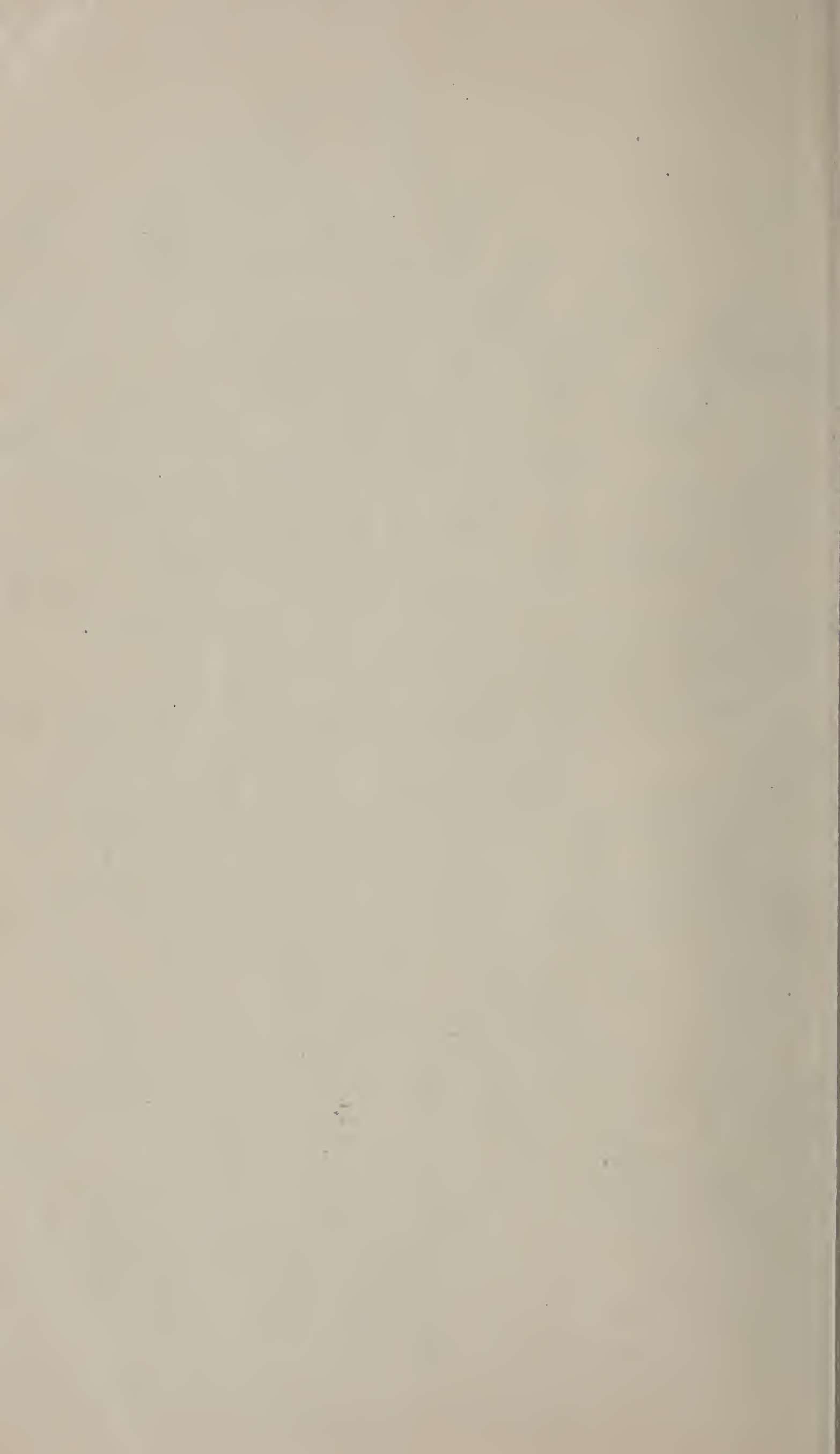


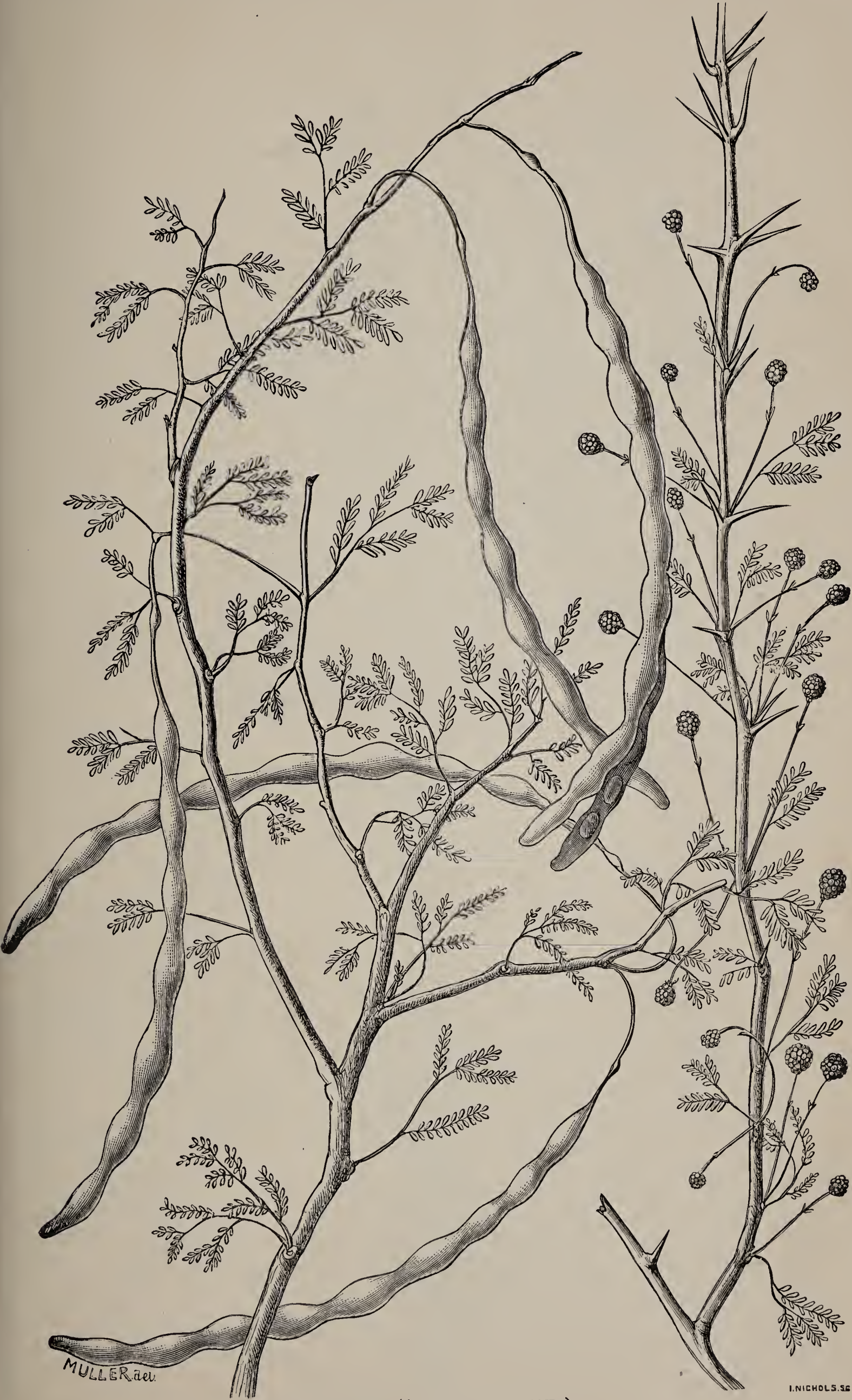


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CREOSOTE BUSH (LARREA MEXICANA).

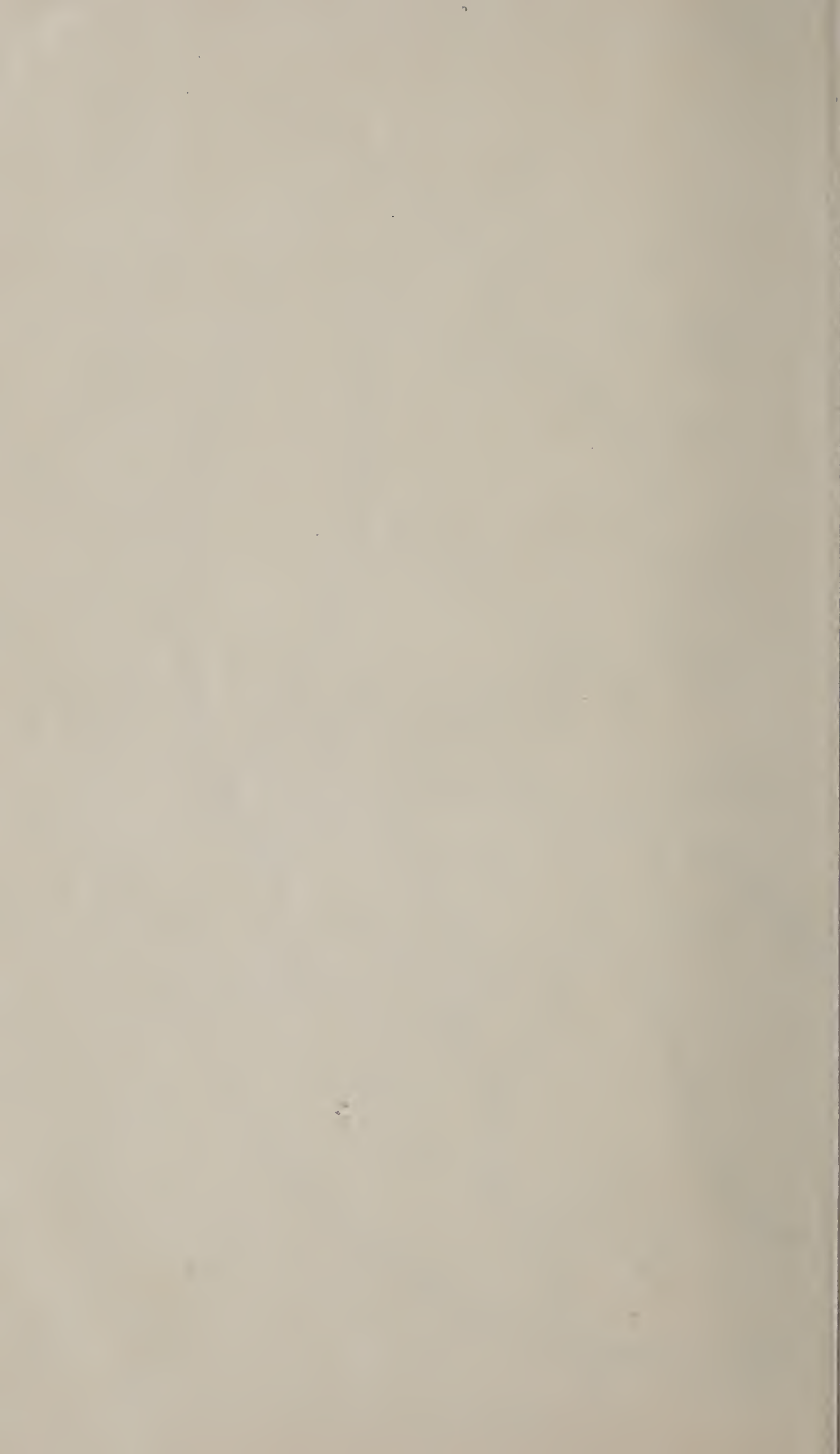






ACACIA BUSH (ACACIA CONSTRICTA).



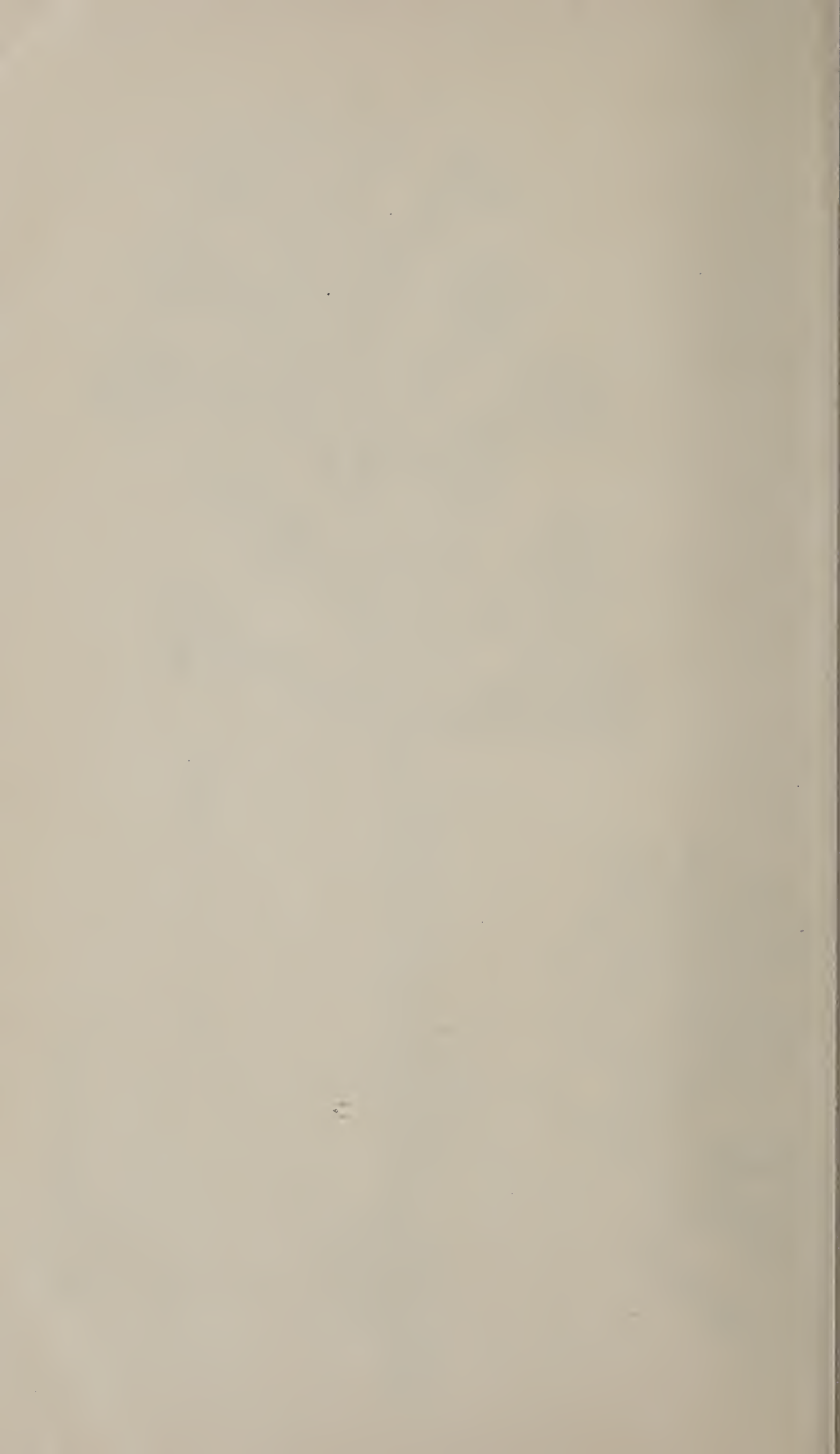




CANDLEWOOD (FOUQUIERA SPLENDENS).

W. SCHOLL. DEL.





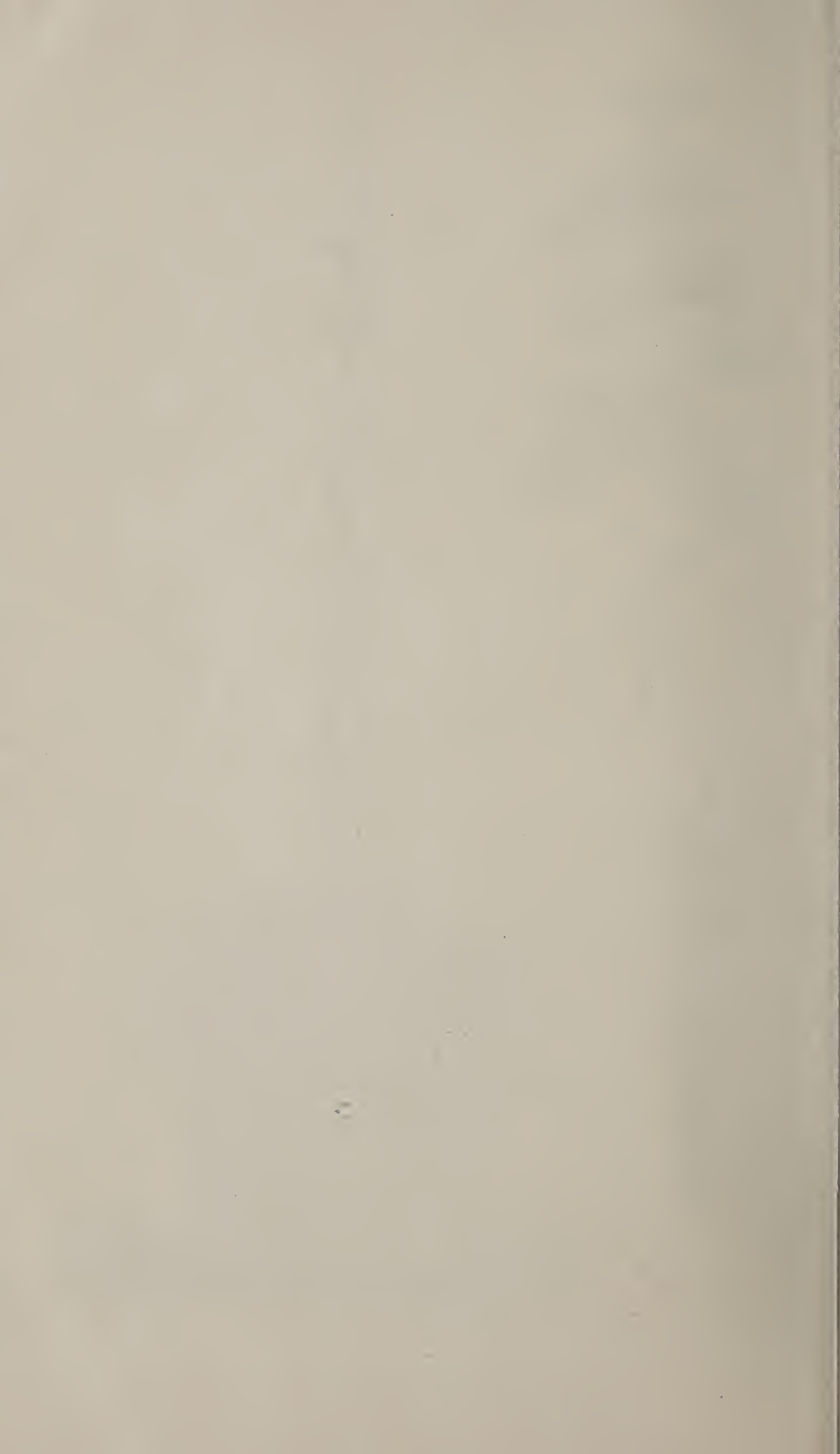


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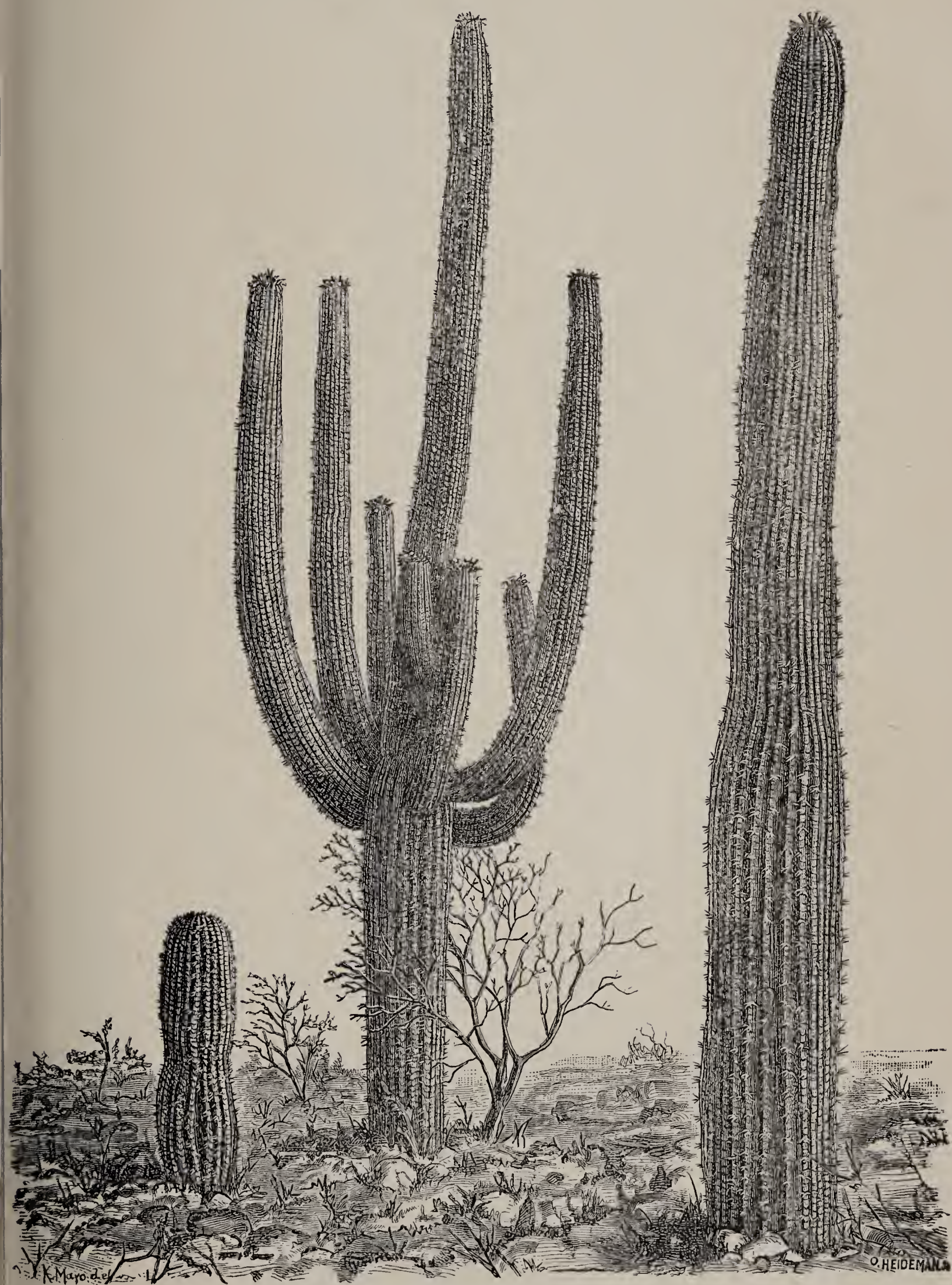
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AMOLE (AGAVE PARRYI).









GIANT CACTUS (*CEREUS GIGANTEUS*).







W. SCHOLL DEL.

PALO VERDE (PARKINSONIA TORREYANA).



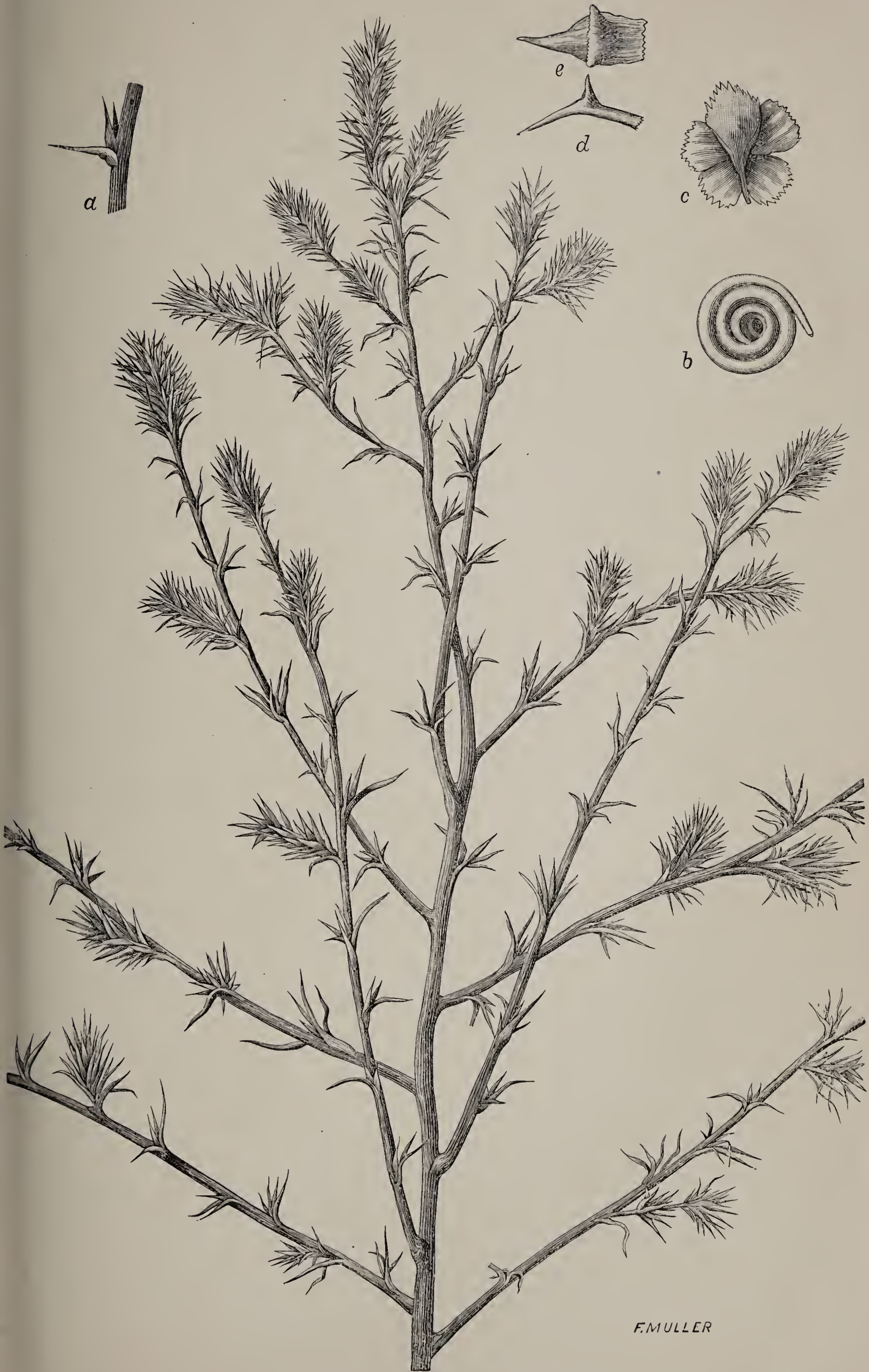




BROOMRAPE (OROBANCHE RAMOSA).







F. MULLER

SALTWORT (*SALSOLA KALI* VAR. *TRAGUS*).



